



MEMORANDUM

TO: Maggie Schmitt and John DePriest, City of Chelsea; John Kosco, Tetra Tech; Ray Cody and Tamara Mittman, EPA

FROM: Horsley Witten Group

DATE: September 7, 2012

RE: City of Chelsea, Massachusetts Development Code Review to Promote Green Infrastructure

The City of Chelsea is an historic, highly-urbanized, diverse, working class community just north of Boston bordered by the Mystic, Chelsea, and Island End Rivers. The City has high-density residential neighborhoods as well as a significant industrial component. Downtown/Lower Broadway is the major commercial area and there are several smaller commercial nodes. Major highways and active rail lines traverse the City; commuter bus and train services are also available. Discharges from the City's Combined Sewer Overflow (CSOs) and the Municipal Separate Storm Sewer System (MS4) contribute to existing water quality impairments of the Mystic and Chelsea Rivers. Existing permits are in place to limit these discharges, but current and/or future Total Maximum Daily Loads (TMDLs) could trigger new permits or lower current permit limits and add to the management cost of reducing these discharges further.

Chelsea is seeking to improve its local water quality by incorporating the use of Green Infrastructure (GI) practices and Low Impact Development (LID) techniques to minimize the impacts of stormwater runoff on water resources. Not only can urban areas be designed to function better hydrologically, there are also significant ancillary benefits (e.g., energy savings from natural cooling, improved aesthetics from the green look, and increased real estate value from the increased curb appeal). Often development codes and standards can work against these goals. Local codes and ordinances can require inflexible standards or incorporate outdated requirements that result in the generation of excessive impervious cover and/or too little usable open space.

This memorandum presents findings by the Horsley Witten Group (HW) from a review of the development regulations and standards relevant to the implementation of GI and LID practices within the City. The purpose of the review was to identify: 1) regulatory updates needed to comply with the 2010 Draft Massachusetts North Coastal Small MS4 General Permit; 2) opportunities for minimizing impervious cover and promoting environmentally-sensitive site design during development and redevelopment activities; and 3) potential barriers to the

implementation of structural GI practices. Since these three objectives are also specific requirements of the 2010 Draft Massachusetts North Coastal Small MS4 General Permit, this memo has been organized accordingly. Submittal of this memorandum with the first annual report of the new permit term might satisfy the City's code evaluation obligations.

HW reviewed the most recent versions of the following documents:

- Part II of the Code of Ordinances, City of Chelsea, Massachusetts, published in 2012 by Order of the City Council, adopted February 27, 2012 (Recodification), with emphasis on Chapter 30 - Water and Sewer Systems and Chapter 34 - Zoning;
- City of Chelsea Planning Board Rules & Regulations Governing Subdivision of Land;
- The Massachusetts State Building Code-Eighth Edition - 2008;
- Massachusetts Stormwater Management Standards (MASWMS) - 2008;
- Massachusetts Wetlands Protection Act;
- Massachusetts State Plumbing Code, CMR 248 (Dec 25, 2009);
- The 2010 Draft Massachusetts North Coastal Small MS4 General Permit (the draft MS4 Permit); and
- Final Massachusetts Year 2010 Integrated List of Waters.

A number of existing guidance documents exist that identify key land development principles to reduce impervious cover, reduce stormwater flows and pollution, and conserve natural areas. For this effort, principles relevant to maintaining, minimizing, and mitigating stormwater impacts were adapted from the Massachusetts Low Impact Development Toolkit (MAPC); the Codes and Ordinance Worksheet (CWP, 1998); the Water Quality Scorecard (EPA, 2009); and Technical Guidance for Assessing Street Design and Parking Standards (EPA Region 1, 2011). Emphasis was placed on site design techniques and stormwater management practices considered appropriate for the high intensity and redevelopment-oriented character of Chelsea. Other environmental constraints were also considered during this review (e.g., high water tables, high bedrock, low permeability or contaminated soils, steep slopes, combined sewers, and impaired receiving waters requiring a TMDL).

The findings presented in this memo are intended to highlight code areas for City staff discussion, rather than provide a prioritized list of recommended code changes. HW will offer potential solutions to the identified issues to help initiate a conversation when the City considers this report. HW's review did not include an evaluation of administrative, inspection, or enforcement procedures; cost/benefit analyses; interviews with agency staff; or work sessions engaging the local regulatory, development, and environmental communities, which would likely precede any formal code update process. Where practical, HW provides alternatives for addressing some of the issues identified, but ultimately it is up to the City to determine the most appropriate recommendations for local implementation.

This memorandum will be accompanied by an upcoming technical guidance document that will provide more detail on the types of GI and LID techniques applicable to Chelsea, particularly for smaller redevelopment sites.

Key Findings

The most significant opportunities to improve in Chelsea's code for GI and LID implementation are listed below, without any assignment of priority. These findings represent those that HW believes will offer the most opportunity to promote GI/LID implementation in the City of Chelsea. These findings are a subset of the more detailed recommendations provided in the remainder of this memo.

- 1) The Draft MS4 Permit proposes the application of state stormwater standards to development and redevelopment projects within the MS4, regardless of proximity to wetlands. Chelsea will likely need to update regulations to address this requirement, either in Chapter 30 of the City of Chelsea Code of Ordinances or by developing a standalone stormwater ordinance;
- 2) Since most projects in Chelsea are redevelopment-oriented and the state stormwater standards for redevelopment projects are subjective, consider establishing locally-appropriate redevelopment criteria to capitalize on redevelopment opportunities for improving existing conditions. For example, the State of Rhode Island recently updated their stormwater management requirements and included a very specific definition of how redevelopment projects are defined, and what standards need to be applied for these sites. These can be found in Chapter 3 of the Rhode Island Stormwater Design and Installation Standards Manual (2010);
- 3) Currently, site plan review is divided into two categories: major and minor projects. Minor projects are less than 8,000 sq ft gross floor area and projects requiring 25 or fewer parking spaces. This threshold might not be low enough to: 1) include projects that can have a measureable stormwater impact; or 2) take advantage of opportunities to improve existing stormwater quality and quantity. Consider reducing this threshold and changing the metric from gross floor area to one that more directly reflects impervious cover. For example, 2,500 sq ft of disturbed area is a typical threshold, where disturbed area includes alterations to impervious cover, or a clearing and grading footprint. Site thresholds could be defined as follows:
 - a. Major projects (~14% of parcels): >8,000 sq ft of disturbance; continue under Planning Board Major Site Plan Approval;
 - b. Minor projects (~57% of parcels): 2,500 sq ft – 8,000 sq ft of disturbance (e.g., minor increase in additional parking, teardown and rebuild); staff review is likely sufficient; objective is to show net improvement of stormwater quality/quantity perhaps through selection of approved options with no calculations required;
 - c. *De minimus* projects (~29% of parcels): <2,500 sq ft of disturbance (e.g., single family homes); continue review by building inspector; consider feasibility of adding directly-connected impervious area (DCIA) estimates to building inspector checklist;
- 4) MS4 communities will likely need to track annual DCIA and become more accountable for restoring impaired waters. To this end, Chelsea should require submittal of DCIA estimates

and pollutant load calculations, where impairments exist, for all development and redevelopment projects above the 2,500 sq ft threshold;

- 5) Establish definitions and performance standards for open space that are in sync with stormwater management goals;
- 6) Good examples exist of incentives for reduced off-street parking requirements in special overlay districts. These could be applied to more areas of the City;
- 7) To better encourage street-side GI practices, consider providing more flexibility in curbing and street design requirements and material specifications;
- 8) Develop local provisions for external stormwater re-use; and
- 9) Consider developing local standards for rooftop practices that are in compliance with state building standards and take advantage of opportunities to enhance open space amenities.

1. Ordinance Actions Proposed under the Draft MS4 Permit

In 2009, Chelsea updated Chapter 30, Water and Sewer Systems, to incorporate illicit discharge detection and elimination (IDDE) requirements; however, once the final MS4 Permit is issued, Chelsea will likely be required to update codes related to post-construction stormwater management criteria and erosion and sediment control for construction sites. Relevant regulations are located primarily in the City's Code of Ordinances (Chapter 30, Water and Sewer Systems), and secondarily in Section IV(F) of the Subdivision Rules and Regulations, and Section 34-110(f) of Chapter 34, Zoning. Findings and recommendations are summarized below.

1.1 Illicit Discharge Detection and Elimination (IDDE): Chapter 30 already contains sufficient language specifying IDDE procedures, infrastructure access, and enforcement authority. Given that a portion of the City has a combined sewer system, it is not surprising that the code contains provisions for dye testing of sanitary and stormwater systems prior to activating water service, establishing Infiltration and Inflow (I&I) mitigation funds, and specifying maintenance responsibilities. No additional updates for IDDE are likely to be necessary, unless the DPW identifies specific regulatory impediments to implementation of the program.

1.2 Post-construction stormwater management: At a minimum, Chelsea will need to revise existing regulations to reference Standards #3, 4, 5, 6, and 7 of the MASWMS, for development and redevelopment projects disturbing more than one acre, *regardless of the proximity to wetlands*. These changes could be addressed by inserting a reference to MASWMS in Chapter 30, Sections 30-220(c) and 30-223, and in the Subdivision Regulations Section IV(F). Alternatively, and perhaps preferably, a standalone stormwater ordinance could be adopted. Updates should address the following issues:

- a. Chapter 30, Section 30-223(b)(4), requires in general the minimization of pollutants and control of rate and volume of runoff discharged from a site as determined by the DPW Director, but does not specify for what storms, nor does it differentiate between peak flow rate and volume. The Subdivision Regulations Section IV(F), states that street drainage systems should be designed in accordance with criteria of the DPW (undefined), be designed to convey the 25-yr storm, and require “no net increase in runoff” with retention/detention basins sized for the 100-yr design storm. Both regulations should be updated to reference the minimum MASWMS criteria for recharge, 80% TSS removal, pollution prevention at hotspots, special requirements for discharges to critical areas, and redevelopment requirements (Standards #3, 4, 5, 6, and 7, respectively).
- b. Consider establishing locally-specific redevelopment standards equal to or greater than the requirement of the MASWMS standard #7 (i.e., show improvement over existing conditions to the maximum extent practicable) and to potentially reflect different stormwater goals between CSO and non-CSO areas. This proposed change might be an opportunity to establish minimum requirements that encourage impervious area reductions and require water quality treatment and/or volume reduction for at least a portion of the site during redevelopment. In Rhode Island¹, for example, redevelopment sites with less than 40% existing impervious cover are required to meet the same stormwater treatment standards as a new development projects. Sites with 40% or more impervious cover must meet stormwater standards using any combination of impervious area reduction, LID techniques, or on-site structural BMPs to manage at least 50% of the impervious cover on site.
- c. Acknowledge the fact that meeting recharge standards might not be feasible at some sites and provide alternative management options, such as the reduction of impervious coverage to benefit CSO areas by reducing rate and volume of runoff, or allowing for enhanced water quality treatment that benefits areas discharging to the MS4.
- d. Establish thresholds for properties, new connections, or redevelopment activities that will trigger compliance with stormwater standards, and clarify which properties are exempt. For example, Ch. 30 Section 30-223 states that “all owners of existing properties shall implement BMPs to minimize stormwater pollution.” The code then states that any new connection, repair, or modification to existing system may require, if deemed necessary by the DPW Director, a stormwater plan, erosion control plan, discharge monitoring, stormwater rate and volume control, and BMPs to control “the characteristics” of discharges. Since smaller redevelopment projects (<8,000 sq ft of disturbance) make up about 86% of the development activity in Chelsea, this kind of project is where there is the most opportunity to improve existing conditions. Consider the following:

¹ Rhode Island Stormwater Design and Installation Manual, December 2010

- Revise the 25,000 sq ft of impervious surface trigger in Section 30-218(m) and require drainage calculations to meet the MASWMS for all projects under major site plan review that meet or exceed a smaller area of for disturbance or impervious area.
 - Reduce the thresholds for Minor Site Plan Review from (a building, structure of less than 8,000 sq ft gross floor area that will not generate the need for more than 25 parking spaces) to a smaller area of disturbance, where disturbed area is defined as a change in impervious cover, clearing or grading footprint.
 - The above reductions could provide an opportunity for the City to: 1) include projects that can have a measureable stormwater impact; 2) take advantage of opportunities to improve existing stormwater quality and quantity; and 3) incorporate minimum redevelopment requirements for onsite stormwater management, impervious area reduction, and open space/ pervious area requirements at smaller redevelopment sites. Site thresholds could be defined as follows:
 - Major projects: >8,000 sq ft of disturbance (e.g. large projects); continue under Planning Board Major Site Plan Approval.
 - Minor projects: 2,500 sq ft – 8,000 sq ft of disturbance (e.g., minor increase in additional parking, teardown and rebuild); staff review is likely sufficient; objective is to show net improvement of stormwater quality/quantity perhaps through selection of approved options (no calculations required).
 - *De minimus* projects: <2,500 sq ft of disturbance (e.g., single family homes); continue review by building inspector; consider feasibility of adding directly-connected impervious area (DCIA) estimates to building inspector checklist.
 - Be consistent in establishing thresholds, specify which activities will be exempt from standards, and identify what the requirements are for approval. For example, 30-218(n) states that drainage plans for residential structures with less than four (4) units shall be approved by the DPW. In this case, the number of residential units is the threshold, which might or might not reflect the extent of site disturbance. In addition, the specific requirements and process for approval of drainage plans is not clear.
- e. Confirm that Ch. 30 Section 30-218(a) gives authority to the DPW to direct owners to repair, and in some instances, retrofit existing private property if the “lack of public drains” impairs water quality or poses other negative impacts. Consider adding “inadequate stormwater management” to list of contributing factors.

- f. Eliminate or revise references to the WEF Manual of Practice No. 9² as this guidance document is no longer available.
- g. Incorporate language that encourages the implementation of GI practices to reduce rate and volume of runoff to the combined sewer system, to take advantage of opportunities for stormwater reuse, and to meet pollutant load reduction goals for the impaired receiving waters. This language could be added to Section 30-223. Examples of GI/LID practices designed for CSO abatement that work in Chelsea would mostly be storage devices like underground chambers, small above-ground basins, or permeable pavement.
- h. Specify minimum Operation and Maintenance (O&M) requirements for private stormwater management systems in Ch 30. Sections 30-218(a) and 30-223(c) that provide authority for the repair and replacement of impaired private drains and require practices to be readily and easily accessible for maintenance, cleaning, and inspection. Examples of maintenance features for GI/LID practices could be a serviceable sediment trap, open access to the practice above ground, or a maintenance port that gives underground access.
- i. Update Section 30-223(c) to require that the design and installation of stormwater practices conforms to the requirements of the building and plumbing code, other applicable rules and regulations of the City, and also to the design requirements of the MASWMS.
- j. Projects that are currently required to provide a property assessment to document that stormwater cannot be retained on-site prior to connection to the City storm drain system (Ch. 30, Section 30-218(m)) should also be required to document water quality treatment, recharge, and rainwater reuse/harvesting limitations.
- k. Add specific language to Ch. 30, Section 30-221 to reflect water quality impairments and TMDL reduction targets for pollutants of concern in the Mystic River, Chelsea Rivers, and Boston Inner Harbor. Update Zoning Section 34-110(f), which references MassDEP's Division of Water Pollution Control, to use a more recent reference to the MASWMS and 303(d) listings under MassDEP. Add "and water quality standards" to the Special Permit criteria Section 34-214(b) of the Zoning Ordinance. The language "Impacts on the natural environment, including drainage" is too vague for considering stormwater and CSO impacts as part of the Special Permit evaluation criteria.

² WEF Manual of Practice No. 9 Design and Construction of Urban Stormwater Management Systems and Gravity Sanitary Sewer Design and Construction, New England Interstate Water Pollution Control, New England Interstate Water Pollution Control Commission Guides for the Design of Wastewater Treatment Works

- l. Ch. 30 Section 30-219(d) states that runoff from gas station canopies and uncovered fuel dispensing areas shall be drained according to “City rules or, in the absence of such rules, as prescribed by the Director.” Clarify what the city rules are, reference MASWMS #5, and recommend required and/or allowable pretreatment practices, such as a sand filter.
- m. While updating the stormwater regulations, consider restructuring Ch. 30 to reduce redundant language between the sanitary sewer and stormwater sections. Also, clarify differences between sanitary and storm systems when using the term “sewage disposal.” Sections 34-214(d)(4) and 34-183(i)(9)(d) of the Zoning Code, for example, do not reference the stormwater system as one of the specific support systems requiring submittal documentation. Evaluation of stormwater impacts should include specific consideration of any downstream combined sewer system.

1.3 Plan submittal requirements: The Draft MS4 Permit proposes tracking of additional information for development and redevelopment projects. Currently, plan submittal requirements can be found in the Subdivision Regulations, Ch. 30, and Section 34-215 of the Zoning Ordinance. Consider revising submittal requirements to improve consistency between the various codes and to address the following:

- a. Add calculations for DCIA and pollutant removal for pollutants of concern to the list of required elements for all plan applications requiring review.
- b. Add watershed location, relevant water quality impairments, and a description of how proposed stormwater management measures meet water quality or CSO reduction goals. This change could be similar to the Zoning Ordinance Section 34-214(d)(2) of the Special Permit submittal provisions that requires descriptions of surface and groundwater impacts including nutrient loading estimates. This addition might not necessitate engineering design, particularly for smaller projects (<8,000 sq ft of disturbance), but rather a description of anticipated stormwater improvements based on a proposed management system.
- c. Revise the “optional list” for what is required in a preliminary plan to include drainage system details in areas draining to impaired waterbodies.
- d. Include long-term O&M procedures for stormwater management practices as part of definitive plans.
- e. Revise Section V(A)(9) of the Subdivision Regulations, to require electronic submittal of as-built plans in electronic CAD format to facilitate stormwater infrastructure mapping updates.
- f. Specify when soil infiltration/percolation tests are required and the appropriate testing procedures to be followed (Subdivision Regulations, Section III(C)(5)).

- 1.4 Erosion and sediment control: To meet the intent of the Draft MS4 permit, Chelsea should consider consolidating erosion and sediment control requirements for construction activities, which are mentioned in Ch. 30 Sections 30-220(2) and 30-223(b)(2), as well as in the Zoning Ordinance Section 34-110(l). As part of the consolidation, the City should consider the following additional updates:
- a. Establish clear triggers for requiring erosion control plans, as well as exempt activities. A clear trigger would be to establish a minimum amount of disturbed area before an erosion and sediment control (ESC) plan is required. The limit of this disturbance should be the same as the *de minimus* threshold of 2,500 square feet.
 - b. Add the installation of temporary erosion and sediment control practices and final stabilization of exposed soils to the list of items subject to inspection (Subdivision Regulations Section VI (D)).
 - c. Include references to the NPDES Construction General Permit requirements and the MASWMS for construction site stormwater management.

In summary, significant changes have been proposed for ordinance additions required under the MS4 Permit. These changes will not only promote the use of GI/LID practices within Chelsea but make it compliant with the MS4 permit requirements. This section of the memo should give the City departments enough information to start the discussions on the relative merits of the proposed stormwater code changes.

2. Minimize Impervious Cover and Promote Environmentally-Sensitive Site Design

Codes related to protecting natural areas, providing flexibility in lot design (e.g., yard setbacks, driveways, rooftop runoff), and reducing excess impervious cover in street design and parking requirements are primarily found in the Zoning Ordinance and in the Subdivision Regulations. Even though the Subdivision Regulations are considered limited in application, they are referenced in the Zoning Ordinance and might have applicability beyond residential construction. For example, Zoning Section 34-215(e)(4) states that applications for major site plan review shall be accompanied by drainage calculations and that “storm drainage design must conform to subdivision regulations.” Under Section 34-215(b)(1), for minor site plan review, the requirements in 34-215(e)(4) might be required. Therefore, recommendations presented here are intended to consider the potential for applying drainage, roadway design, and material specifications in a broader context. The following are specific recommendations to help avoid, reduce, and better manage stormwater impacts during the site design process:

2.1 Good examples: Chelsea has many good examples of codes that promote environmentally-sensitive design that could be applied more broadly throughout the City, such as:

- Subdivision Regulations Section IV(A)(6)(a) states that street grading standards are established “to promote environmentally-sensitive design by incorporating flexibility into design standards and regulations.”

- The Smart Growth Overlay District was created to promote compact design, open space preservation, and context-sensitive design, as evidenced by the reduced parking requirements.
- The Residential Planned Overlay District (Zoning Section 34-185) establishes standards “to allow for creative site planning and design” and “utilizes infiltration practice to reduce runoff volume (34-185(e)(6)(d)).”

2.2 Natural Areas and Open Space: There is limited applicability for natural area protection in the City, however, there are opportunities to enhance and restore open space for improved active and passive recreational use, aesthetics, canopy cover, and perhaps, stormwater management. There is no local wetland ordinance or discussion of vegetative buffer zones, other than the provision of a minimum 30-ft easement around a watercourse/drainageway (Subdivision Regulations Section IV(C); a land setback and/or easement of 15 ft from the mean high water line or harbor street in the Waterfront District (Section 34-77(c) in Zoning); and a 30-ft setback from the waterfront for green space, plazas, or pedestrian malls (Zoning Section 34-155(2)(b)) for an applicable Planned Development project.

Provisions related to open space are found in the Subdivision Regulations, Sections IV(D-E) and in the Zoning Ordinance (Sections 34-78(d), 34-78(l), 34-155(i), and in the dimensional table for some of the zoning districts). Section 34-214(d)(4)(e) might require a discussion of recreational provisions for special permit applications where a development impact statement (DIS) is required. Lot coverage requirements for each zoning district are based on **building** footprint and do not necessarily include parking lots, driveways, patios, etc; therefore, there is no pervious area requirement for lots other than for useable open space, which is discussed in Section 34-78(d). At a minimum, the City should consider the following:

- a. Add definitions for “watercourse” and clarify the definition for “useable open space” or “open space” in both the Subdivision Regulations and the Zoning Ordinance. Open space could be defined as the “pervious” portion of a site, which might include naturally vegetated areas or other areas used for active or passive recreational, or stormwater management, including rooftops, plazas, malls, etc. Revise the “lot coverage” definition to reflect all impervious cover on a site.
- b. Establish clear standards for useable and non-useable open space in all zoning districts (e.g., percent of total site area, impervious limitations, specific landscaping/vegetative targets, and pedestrian circulation guidance depending on the type of active or passive use). For example, open space requirements could be set as a percentage of lot size, number of units, or proximity to public open space (e.g., 30% of lot area for retail businesses with credit applied for public open space area within 300-1,000 ft of entrance). Where feasible, rooftops, plazas, parks, basketball courts, etc should be designed to generate no additional off-site runoff and also meet canopy cover and other

appropriate vegetative targets. The integration of open space and stormwater management goals should be a factor in establishing these standards.

- c. Subdivision Regulations Section IV(D) states that lands reserved for open space shall be “graded to dispose properly of surface water.” Consider revising this statement to eliminate reference to disposal of surface water and replace with a statement oriented towards proper conveyance of stormwater across a site. For example, encourage the use of GI/LID practices that can enhance the landscape and also provide appropriate stormwater controls.
- d. Consider adding more specific criteria or reference procedures for determining which individual trees are protected by Subdivision Regulations, Section IV(E).
- e. Where the requirements for useable open space might be waived by the Inspector of Buildings to allow for additional off-street parking (see Zoning Section 34-154(b)), require that parking to be pervious or otherwise managed to meet a “no net increase in off-site runoff” criteria.

2.3 Lot Setbacks: There are reasonable provisions for flexibility in yard setback requirements and building placement on lots. No further action is suggested.

2.4 Street Cross Sections and Driveways: Many of the street and driveway design standards and material specifications required in the Subdivision Regulations might find application during some redevelopment scenarios (e.g., driveway requirements applied to new hotel entrances or curbing and road paving requirements after sewer separation work). Therefore, consider addressing the following:

- a. The location and cross section requirements for streets are found primarily in the Subdivision Regulations Section IV(A) and V(B). Revise the general streets description to incorporate GI practices and reduced impervious cover goals for the design and layout of new and repaved/relocated roads. In particular:
 - Provide flexibility for reducing the minimum pavement and right-of-way widths (34 ft and 50 ft, respectively) for minor roads where feasible;
 - Revise curbing requirements to allow a non-curb or alternative curbing options to facilitate use of vegetation, tree pits, and other GI practices in the road right-of-way;
 - Provide locally-approved details for curb cuts, catch basin modifications, and street-side practices;
 - Revise Subdivision Regulations, Section V (C)(3) that specifies that the stormwater collection system shall consist of catch basins and pipes set along both sides of the road at intervals not exceeding 250 ft, a requirement that could prevent alternative drainage designs;

- Ensure that roadway cross section materials specified in Section V (B)(3) do not prevent use of porous pavement. Consider explicitly allowing for porous materials to be used within portions of the road system; and
 - Provide some flexibility in street layout and alignment requirements to allow for environmentally-sensitive designs.
- b. Section IV(B) requires residential driveways to be a minimum of 10-ft to 16-ft wide depending on the number of families. For multi-family residential, the Fire Department prefers an 18-ft wide access. In contrast, the Metropolitan Area Planning Council (MAPC) recommends a 9-ft minimum width. The City departments will have to work together to resolve the conflicting goals of public safety and stormwater reduction. In addition, there does not appear to be a restriction on the use of pervious driveway materials or two-track designs, although driveways are not allowed to be installed at the same location as drain inlets, which potentially could cause design conflicts.
 - c. Section IV (A)(7) requires all turnarounds to be cul-de-sac designs with a 100-ft diameter and landscaped islands are explicitly allowed. Alternative turnarounds such as “hammerheads” can reduce impervious cover. A minimum cul-de-sac radius of 35 ft is recommended by MAPC under some circumstances. Where central landscape islands are installed, consider establishing planting standards and allowing the island to be used as stormwater management, which might require attention to easement and ownership provisions.
 - d. Section V(D)(1-4) requires a minimum 5-ft wide paved sidewalk to extend the full length and along both sides of the street with a 4-ft wide grass strip. This requirement adds impervious area, does not necessarily promote pedestrian-friendly transit, and might not be necessary for most residential roads. This section also provides specifications for bituminous concrete and concrete pavements. Ch. 24, Section 24-24, states that every sidewalk within the City should be built under the direction of the DPW. Ensure that the DPW allows for pervious materials to be used for sidewalks. Consider allowing variable sidewalk widths and layouts, particularly where connecting open space, residential areas, schools, and retail businesses. For example, pervious pavement could be used in areas like adjacent to elderly housing where there is an existing safety issue associated with slipping on winter ice and narrower sidewalks could be used where there is little foot traffic.

2.5 Parking. Chelsea has done a good job minimizing parking area and providing flexibility with its parking standards. Zoning Section 34-106 outlines off-street parking requirements. The parking ratios and the stall and drive aisle dimensions are minimal (e.g., 9 x18 ft stall minimums and 24-ft aisle width for 90 degree parking); shared parking credits are permitted; and compact car spaces are allowed (up to 25%) in lots with 10 or more spaces. In addition, incentives for enclosed parking are provided that include stall size reductions (8.5 -7.5 ft wide x 18-16 ft in length), increased compact car percentages (from 25% to 50%),

aisle width reductions (22 ft minimum for 90 degree parking), and bonus floor area ratios. Consider applying some of these provisions City-wide and address the following:

- a. Add proximity to public transportation, public parking garages or surface parking lots, or available on-street parking to the list of allowances for reduced off-street parking requirements (Section 34-106(j)) as illustrated in the Smart Growth Overlay District (Section 34-183(f)(3)) that strongly encourages shared parking particularly where “an MBTA transit station or bus stop is close by.” Define proximity as being within a minimum of 300-1,000 ft of main building entrances.
- b. Revisit current parking ratios based on local demands and future projections (see Section 34-183(f)(3) in the Smart Growth Overlay District for recommended protocol references for determining demand). MAPC recommends no more than 1 space for every 1,000 sq ft gross floor area for shopping centers; Chelsea currently requires one space per 900 sq ft for the first 50,000 sq ft gross floor area, then one space for every additional 600 sq ft.
- c. Establish both minimum and maximum parking ratios, and/ or require additional parking above the specified minimum values to utilize pervious materials.
- d. Eliminate percent of compact car spaces allowable (Section 34-106(d)) or increase percent allowable from 25% to 30% (MAPC suggests allowing 30%) to preserve parking garage incentives.
- e. Add “pervious pavement and pavers” as allowable materials to the surface requirements for parking lots (Zoning Section 34-106(g)). Delivery of small volumes of permeable concrete or asphalt is sometimes difficult for small areas but permeable pavers can still be used in those cases.
- f. Require pervious parking for reserve parking areas subsequently converted from open space to parking (Zoning Section 34-106(j)).
- g. Encourage applicants to meet Leadership in Energy and Environmental Design (LEED) outdoor illumination standards under Section 34-106(d)(6) for parking lot lighting requirements.
- h. Increase landscaping requirement for parking lots, and specifically state that use of landscaped areas for vegetated stormwater practices is encouraged.
- i. Section 6-3 of Chapter 6 of the City of Chelsea Code of Ordinances establishes the Traffic and Parking Commission. Investigate further any potential conflicts between the Commission and Planning Board when it comes to parking standards.

2.6 Landscaping requirements: Landscaping requirements are provided in the Zoning Ordinance (Section 34-108). Opportunities exist to strengthen these provisions by providing vegetative standards for areas other than property line screening (e.g., parking lot islands, sidewalk and road ROWs) and by integrating more explicitly with open space and/or pedestrian circulation provisions. Consider the following:

- a. Adding to the purposes outlined in Section 34-108(a) language stating explicitly that landscaping provides an opportunity to integrate vegetated stormwater management practices.
- b. Establish performance standards that define a “sufficient amount” of landscaping for planned developments (Section 34-155(i)(4)).
- c. Add language for integrating stormwater management within the definition of landscaped area in Section 34-241 of the Zoning Ordinance.
- d. Establish canopy coverage targets (e.g., 35% sidewalk coverage within a specified time after planting) to expand on street tree spacing guidelines found in the design guidelines for R3, BR2, and LI2 Districts (Zoning Section 34-216(c)), which reference achievement of “a continuous canopy” upon maturity.

2.7 Pollution prevention: In addition to the IDDE requirements, Chelsea has good examples of source control requirements, such as pet waste pickup, no washing or repairing of vehicles in streets or on sidewalks, and no watering of sidewalks and streets. Consider updating dumpster location and enclosure regulations (City of Chelsea Code of Ordinances, Chapter 22, Sections 22-113 and 22-114) to prohibit the placement of an uncovered dumpster above or within the direct drainage path to a storm drain inlet, unless drainage is conveyed directly to a treatment practice. Dumpsters should be covered or placed within covered enclosures.

In summary, only modest changes have been proposed for minimizing impervious cover and promote environmentally-sensitive site design. Chelsea already has many good examples of codes that promote environmentally-sensitive design. These modest changes will not only promote the use of GI/LID practices within Chelsea but also make the City look and feel greener.

3. Other Measures to Promote Implementation of GI Practices

In addition to the items mentioned above, the following findings and recommendations are suggested to further promote GI alternatives or to remove regulatory hurdles for specific GI practices such as green roofs, tree filters, porous pavement, etc.

3.1 Direct references to GI and LID: Consider the following opportunities to insert GI-specific language:

- a. Ch. 30 Section 30-223 could be updated with specific language identifying the use of GI as a method to improve water quality conditions and reduce runoff to the combined sewer system and/or separate drainage system. Consider options that encourage selection of practices for runoff rate and volume reduction practices in CSO areas;
- b. Add “to promote green stormwater infrastructure” to the purposes of Planned Development in the Zoning Ordinance (Section 34-155(a)) and add stormwater management as one of the review factors for designing planned developments (Section 34-155(i)).
- c. Add “to prevent surface water pollution” to the purposes of the waterfront industrial overlay district (Zoning Ordinance, Section 34-179(a)).
- d. Ch. 30, Section 30-223(b)(5) specifies the use of oil/grit (O/G) separators, at a minimum. Update this section to recommend a broader selection of GI practices, many of which might provide better pollutant removal than a particle separator. O/G separators and proprietary practices should meet pollutant removal efficiencies in accordance with criteria in MASWMS.
- e. If portions of the Naval Hospital Residential District or Naval Hospital Commercial District are subject to the Department of Navy jurisdiction (this might not be the case), consider referencing the Department’s 2007 Policy on Low Impact Development, which requires construction and redevelopment projects to meet a “no net increase in stormwater runoff” through the application of LID techniques. The 2007 Energy Independence and Security Act requires development or redevelopment projects involving a Federal facility with a footprint that exceeds 5,000 sq ft to maintain predevelopment hydrology using an LID/GI approach.

3.2 Rooftop practices (e.g., green roofs, cisterns, and blue roofs):

- a. Height regulations (Zoning Section 34-78(j)) already exempt water tanks and cisterns from height restrictions, except for in the Naval Hospital Residential District and in existing or planned approaches to Logan Airport. Consider adding dimensional relief incentives (e.g., more stories) for buildings with green/blue roof infrastructure (Section 34-80(1), where feasible.
- b. Rooftops might in certain circumstances already count for meeting useable open space requirements as described in Section 34-78(d) of Zoning Ordinance. This might provide an incentive for green roofs or blue roof³ applications, and might be an example for how to encourage other GI practices. Consider including criteria for determining how much open space credit can be provided for green and blue roofs.

³ Blue roofs are rooftop storage practices that are designed to attenuate precipitation and reduce the volume and frequency of CSOs.

- c. Ensure that recommended building rooftop design elements do not create impediments to cisterns, green roof, or other GI practices for visual purposes in design review (Zoning, Section 34-216(c)).
- d. Chapters 15 and 16 of the 2009 International Building Code and the 8th Edition of the Massachusetts Building Code provide minimum dead and live load requirements for landscaped roofs and discuss structural requirements for structures supporting tanks with a capacity of 500 gallons or more. These load requirements will increase the cost of roof design where a green roof or rooftop storage tanks are desired. The following is a list of specific Building Code items that might be relevant to stormwater re-use, and green and blue roof applications:
 - (1509.3) Tanks having a capacity of over 500 gallons placed in or on a building shall be supported on a masonry, reinforced concrete, steel, or Type IV construction provided that, where such supports are located in the building above the lowest story, the support shall be fire-resistance rated as required for Type IA construction.
 - (1509.3.2) Tanks shall not be placed over or near a line of stairs or an elevator shaft, unless there is a solid roof or floor underneath the tank.
 - (1509.3) Roof gardens shall comply with Chapter 16-Structural Design
 - (1607.11.3) Where roofs are to be landscaped, the uniform design live load in the landscaped area shall be 20 psf. The weight of the landscaping material shall be considered as dead load and shall be computed on the basis of saturation of the soil.
- e. The 2012 International Building Code includes new provisions related to green roofs (called roof gardens) that the City should review prior to encouraging green roof applications, as it is likely that these codes will eventually be adopted into future editions of the Massachusetts Building Code. Specifically, Section 1507.16.1 prohibits a one-hour fire rating reduction in conjunction with rooftop gardens. Section 1507.16 references the International Fire Codes that include roof garden size limitations, separation distances from combustible rooftop elements, vegetation maintenance standards, and standpipe extension requirements.

3.3 Stormwater Re-use: Neither local codes nor the Massachusetts Plumbing Code appear to contain any specific references to stormwater re-use. The following recommendations are offered:

- a. Promote rainwater harvesting by requiring an evaluation of stormwater reuse opportunities prior to allowing drains to be connected to the MS4 or CSO drainage network (Ch. 30, Section 30-197).
- b. Update Section 30-100 on water conservation to discuss stormwater re-use opportunities using cisterns, blue roofs, etc.
- c. Update Ch. 24, Section 24-52 for wells, cisterns and other excavations near public ways to discuss cisterns for stormwater re-use.

- d. The following is a list of specific State plumbing code items that might be relevant to stormwater re-use:
- 10(05) requires that drainage piping maintain minimum slopes based on pipe diameter (e.g., three inches in diameter or smaller shall be installed with a minimum uniform pitch of 1/4 inch per ft);
 - 10(14.7.b) In water distribution systems that have potable and non-potable water, all pipes must be marked and tagged to identify the type of water distributed;
 - 10(14.7.j) Water recycling is generally prohibited, but dedicated gray water, black water, and onsite wastewater treatment systems exceptions are provided. Since stormwater/rainwater re-use is not explicitly approved in this State code, the City should consider the feasibility of specifically allowing stormwater/rainwater re-use in its stormwater code with the caveat that the State might still not allow this change. Gray-water is defined as “used water out-flowing from a clothes washer, shower, bathtub or bathroom sink and reused on the same site for below ground irrigation.” A dedicated gray-water recycling system includes all piping, valves, pumps, meters, retaining tanks for exterior or interior gray water collection points; and,
 - 10(17.8) Roof drain materials used must meet plumbing code specifications (i.e., cast iron pipe).

3.4 Practices in the Road Right-of-Way and/or Sidewalks (e.g. tree pits, porous pavement, linear bioretention; planter boxes):

- a. Ensure that landscaping screening and window/façade requirements in the smart growth overlay district (Zoning Ordinance, Section 34-183(g)) or in design review under Section 34-216(c) do not restrict the use of stormwater planters, filter boxes, or other streetscape practices generally located in front of buildings and along sidewalks. This is particularly important where 4-ft tree lawn and/or tree pits are recommended, sidewalk widths are recommended to be 8-ft minimums with 3-ft tree pits, or vegetation height is recommended to be restricted. Consider revising design guidelines that affect road right-of-way and/or sidewalks to be more flexible for GI/LID practices.
- b. Zoning Section 34-78(c) limits vegetation greater than 2.5 ft above curb grades up to 20 ft from property lines of intersecting streets; this does not apply in the retail business district. This could potentially limit green street practices in other zoning districts. Consider allowing taller vegetation like small trees when GI/LID practices are used.
- c. Subdivision Regulations Section IV (H) require street trees to be planted within a root barrier; this might preclude the use of GI practices such as infiltrative tree filters. The regulations also require 4 ft of grass between the sidewalk and street, which could prevent alternative street-side stormwater practices or reduce vegetative options. Consider removing these restrictions to promote GI/LID practices.

- d. Ch. 30, Section 30-218(g) requires that construction of storm drains be at least 10 ft from any new or existing water service connection. This could be a potential site constraint on small lots; therefore, consider reducing the distance to 5 ft.
- e. Revisit snow management provisions (Ch. 24, Sections 24-7 and 24-21) to ensure that snow removal/storage regulations do not prohibit street-side or parking lot GI practices. Consider allowing more flexible snow removal rules when GI/LID practices are used.
- f. Ensure that Ch. 24, Section 24-17, which prohibits the discharges of water on or across a City sidewalk or public way, does not prohibit a shared stormwater management system, or a management system located within the layout of a public way (e.g., pervious paver alley, tree filters, porous sidewalks, etc.)

In summary, a number of other measures to promote implementation of GI practices have been presented in this section. Many of these changes will help promote the use of GI/LID practices within Chelsea and change the City's "green" look. The City departments should have enough information from section to start the conversation on the relative merits of these other proposed code changes.

Additional References

Center for Watershed Protection (CWP), 1998. *Better Site Design: A handbook for changing development rules in your community*. Available online at www.cwp.org.

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Klein & Associated, Marshall A, October 13, 2011. *Important Changes to the 2012 International Building Code and International Fire Code that Relate to R-2 Occupancies*. Retrieved March 26, 2012 from www.nmhc.org/Content/ServeFile.cfm?FileID=9141.

Metropolitan Area Planning Council (MAPC), no date. *Massachusetts Low Impact Development Toolkit*. Available online at www.mapc.org/sites/default/files/LID_Local_Codes_Checklist.pdf.

Rhode Island Department of Environmental Management and Coastal Resources Management Council, December, 2010. *Rhode Island Stormwater Design and Installation Standards Manual*. Available online at www.dem.ri.gov/pubs/regs/regs/water/swmanual.pdf.